

13 February 1978

Mapping, Charting, and Geodesy

**STANDARDIZATION, EVALUATION, AND QUALITY ASSURANCE FOR
US AIR FORCE RECONNAISSANCE IMAGING SYSTEMS**

This regulation states policies and assigns responsibilities for the quality assurance program of imagery sensor support systems. It sets up the quality assurance requirements for continuous photographic laboratories serving RF-4C, U-2R, SR-71, photo drone, and imagery related intelligence production organizations. It applies to Intelligence Precision Photographic Officers, Continuous Photoprocessing, and Photoprocessing Control specialties.

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Supersedes AFR 96—1, 10 January 1975. (For summary of revised, deleted, or added material, signature page.)

No. of Printed Pages: 9

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SECTION — INTRODUCTION

1. General Information:

a. Imagery-recording systems continue to provide one of the major sources of information to satisfy intelligence requirements. The greatest amount of information must be obtained from the acquired imagery. This requires that each component of the reconnaissance cycle be considered in terms of its possible effect on other aspects of the cycle. Controls must be set up to lessen degrading effects.

b. The levels of quality obtainable from reconnaissance missions vary with the sensor system, the operating conditions, recording media, processing and printing characteristics, and other related factors. The capabilities of the supporting facilities also vary according to their assigned mission. Therefore, variations must be identified in order to set up quality controls and make sure that the greatest amount of information is derived from the imagery.

c. Since the primary means of reconnaissance collection are currently optical sensors, this regulation is concerned with the quality assurance of optical sensor support systems. Quality assurance programs for other types of reconnaissance systems will be developed as these systems are developed and fielded.

SECTION B — LABORATORY QUALITY ASSURANCE PROGRAM

2. **The Need for a Quality Assurance Program.** To maintain effective quality assurance, each laboratory must set up a Quality Assurance Program and develop process standards for each sensor and film type. These standards must be consistent with the manufacturers' specifications, laboratory capability, and DoD requirements, as appropriate.

a. **Meeting Mission Requirements.** There is no single quality assurance specification that covers all reconnaissance programs. However, it is possible to identify criteria for photographic quality in order to get the most information from a given reconnaissance system. Once the "quality goal" has been determined, it is necessary to trace through the various laboratory activities to find which variables affect the final product quality. Then control tolerances are assigned to each variable in such a way as to make sure the overall "quality goal" is achieved. When the "quality goal" has been identified, the operating criteria for each procedure in the laboratory can be defined. From this point, the quality control program makes sure that the standards are maintained within specified limits.

b. **Reliability of Product Quality.** If variability is under control, the reliability of the production of the laboratory is assured. Laboratory management makes sure that the laboratory system operates

within repeatable limits and in a prescribed manner. Quality control applies to the mechanical laboratory functions as well as all laboratory activities, including the performance of the operators and maintenance personnel.

3. **Laboratory Quality Assurance Functions.** The laboratory quality assurance program can be separated into specific steps that interrelate to form the total program. These steps are:

a. **Identifying Variables.**

b. **Using Instruments.** Whether these devices are simple or complex, their repeatability and accuracy must be known. They must be calibrated periodically against a standard.

c. **Collecting and Presenting Data.** Quality assurance data must be collected and recorded accurately and uniformly. The data is presented on AF Forms 1600, Sensitometry Worksheet; 1601, Spray Processor Temperature and Pressure Log; 1602, Original Negative Evaluation; 1603, Mission Densitometric Readout Data; 1604, Titling Checklist; and 1605, Equipment Certification. Laboratories with immersion processors, prototype equipment or specialized items, such as automatic plotters and computer interface printers, are authorized use of locally produced forms for those specific items not covered by existing Air Force forms.

d. **Analyzing and Integrating Data.** Analysis of data begins with examining control charts for abnormal deviations from the mean. When deviations indicate a trend, all variables must be analyzed before making any change. If a change is made to correct a deficiency in the process, subsequent data must be closely monitored to make sure that control has been restored. If the corrective action fails to restore control, the operation is suspended and a detailed analysis made. Because interaction between variables must be considered, decisions are made only after conducting an analysis of variance.

4. **Categories of Imagery Processing Laboratories.** All Air Force processing laboratories used in support of reconnaissance activities are divided into categories based on mission, capability, and final use of imagery products. These categories define the extent of processing, printing, duplicating, and support requirements associated with various missions. The categories and the regular requirements for each laboratory are:

a. **Category "A" Laboratory.** A laboratory capable of supporting those photographic reconnaissance systems responsible to national command assignment authority. It consists of a secure, clean, temperature and humidity controlled production facility with the capability to process long, uncut rolls of thin base, original negative film. This laboratory does the necessary film breakdown, identi-

fication, titling, and duplicate film production required for wide distribution. Laboratories associated with Category "A" include major command Reconnaissance Technical Facilities within the General Defense Intelligence Program (GDIP).

b. Category "B" Laboratory. A laboratory supporting command level or theater intelligence production work. This laboratory has enough processing and printing equipment to handle the workload of the command or theater. Also, this laboratory services follow-up reconnaissance products intended for detailed evaluation. Laboratories associated with Category "B" include fixed or mobile Reconnaissance Technical facilities supporting responsive intelligence production.

c. Category "C" Laboratory. A laboratory supporting mobile or deployed tactical reconnaissance operations. This laboratory has the full capability to support the processing and select printing required for Immediate Photographic Interpretation Reports (IPIRs). Category "C" includes the WS-430B Photographic Processing and Interpretation Facilities.

d. Category "D" Laboratory. A special purpose facility required to support a specific reconnaissance operation. This type of laboratory may be equipped with a wide variety of specialized processing or printing equipment to support one particular mission or reconnaissance sensor. Category "D" includes AFSC and AFLC facilities, support laboratories, and prototype equipment undergoing extended operational test and evaluation.

5. Calibration and Certification Standards. To make sure that the best imagery is being produced at all times, all continuous photographic processing laboratories must maintain at least minimum standards for equipment certification and calibration, imagery evaluation, statistical evaluations, and exposure monitoring systems. TO 10-1-6-2 provides the definitive guidance for this requirement.

a. Calibration of equipment in all laboratory categories must be performed as specified in TOs 10-1-6-2, 33K-1-100, and the appropriate equipment TO. Sensitometers and densitometers must be calibrated every 12 months.

b. Certification, standardization, and quality assurance procedures must be performed at, or exceed, the frequency listed in attachments 1 and 2, for each respective category.

SECTION C — CENTRAL CALIBRATION PROGRAM

6. General Information. This section assigns responsibilities to the USAF Central Calibration Facility (USAF/CCF), Major Commands (MAJCOMs), the Major Command Central Calibration

Facilities (MAJCOM/CCFs), and the photographic processing facilities. The central calibration program is now limited to calibrating sensitometers and diffuse densitometers.

7. MAJCOM Responsibilities. Each MAJCOM sets up a calibration program for sensitometers and densitometers. Each MAJCOM headquarters designates a MAJCOM/CCF and notifies HQ USAF/INY and the USAF/CCF of the assignment. MAJCOMs also designate each facility required to requisition USAF/CCF sensitometer and densitometer calibration packages. When a command standard sensitometer is used to produce secondary calibration packages for its using activities, each MAJCOM OPR must make sure that all sensitometer exposures correspond, within established tolerances, to exposures produced from the USAF/CCF standard sensitometer.

8. Diffuse Densitometer Calibration Responsibilities:

a. USAF/CCF:

(1) Demonstrates traceability of diffuse density measurements to the National Bureau of Standards (NBS).

(2) Calibrates step-tablets for diffuse densitometers.

(3) Provides item management for calibrated densitometer step-tablets.

(4) Maintains liaison with Aerospace Guidance and Meteorology Center (AGMC) on the densitometer calibration program according to AFR 74-2.

(5) Supports the MAJCOM/CCF in resolving densitometer calibration problems.

b. MAJCOM/CCF:

(1) Monitors the command densitometer calibration program and supplements procedures as required.

(2) Supports their using activities by resolving densitometer calibration problems.

c. Using Activities:

(1) Requisition the nationally stock listed calibration densitometer step-tablet at least every 12 months. Establish an expiration date of the calibration densitometer step-tablet 12 months from the date of initial use. Write date on the AFTO 108, PME Certification Label. This step-tablet must be used as the facility standard to calibrate work standards.

(2) Maintain step-tablet work standards which are traceable to the facility standard. Expired facility standards must be used as work standards as long as the physical condition is acceptable.

(3) Using the calibrated step-tablet work standard, certify the diffuse densitometer according

to TO 10-1-6-2. If the densitometer fails to certify, it must be calibrated according to the equipment calibration procedures in the appropriate densitometer technical order (TO).

9. Sensitometer Calibration Responsibilities:

a. USAF/CCF:

(1) Demonstrates traceability of exposure in metercandle-second (MCS) to NBS.

(2) Produces a sensitometer calibration package consisting of two rolls of film of the same emulsion. One roll must have a calibrated step-tablet exposure and the other roll must be unexposed. The exposed film must be aged to reduce latent image effects. The sensitometer calibration package must be stored under controlled conditions at all times. Keep appropriate records so as to allow periodic verification.

(3) Provides item management for the sensitometer calibration packages.

(4) Analyzes the data returned from the using activity, determines the exposure made by the sensitometer to be calibrated, and notifies the using activity and the appropriate MAJCOM/CCF of the exposure value.

(5) Maintains liaison with AGMC on sensitometer calibration procedures according to AFR 74-2.

(6) Supports the MAJCOM/CCF in resolving sensitometer calibration problems.

b. MAJCOM/CCF:

(1) Monitors the command sensitometer calibration program and supplement procedures as required.

(2) Supports their using activities in resolving sensitometer calibration problems.

(3) If a command standard 1-B Type sensitometer is to be used to produce secondary command sensitometer calibration packages, develops procedures to make sure that calibration sensitometers correlate with the USAF/CCF standard sensitometer exposure.

(4) Produces sensitometer calibration packages for those using activities not requisitioning packages from USAF/CCF.

c. Using Activities:

(1) Requisition the sensitometer calibration package for the type of sensitometer to be calibrated at least every 12 months.

(2) Calibrate the facility standard sensitometer according to TO 10-1-6-2, and as supplemented per instructions contained in the calibration package.

(3) Produce exposures on control stock film using the facility standard sensitometer at the time of calibration. These exposures are used for later calibrations and certifications.

(4) Calibrate all sensitometers in the facility by determining the exposure from correlation to the

calibrated facility standard sensitometer. Do every 12 months.

(5) Monitor sensitometer calibration according to TO 10-1-6-2 to determine when maintenance is required.

SECTION D — SENSOR SYSTEM EVALUATION PROGRAM

10. Scope of the Program. The sensor system evaluation program is the Air Force effort to determine the performance of specific imaging systems. Actual system performance is then compared against expected standards. The sensor system includes such variables as the aircraft, camera, film, processing, and environmental conditions. The sensor system evaluation program provides a measure of the quality of the product to be used by the imagery interpreter. The degree of evaluation can range from limited visual inspection to in-depth study and documentation requiring sophisticated instrumentation. The sensor system evaluation programs allow identification of probable system degradation causes and make sure that corrective action methods are set up.

11. Nominal Performance Standards [NPS]. The key element in the sensor system evaluation program is the NPS. The NPS specifies in terms of image quality the operational performance of a sensor system under a given set of conditions. The NPS includes a sensor system description, expected values of imagery quality, and references to appropriate documents. It provides a common technical evaluation baseline among Air Force organizations. The NPS can be set up around operational systems, controlled flight tests or static laboratory tests, and will vary for each set of conditions.

12. Organization Responsibilities:

a. Sensor System Evaluation Steering Group. This Group is made up of members from all commands with reconnaissance responsibilities and is chaired by HQ USAF/INY. It determines priorities, approves specific NPS formats, and coordinates the necessary command interface required in the sensor system evaluation program. The Group recommends specific functions and responsibilities for user commands, supporting organizations, and staff activities concerned with sensor system improvement.

b. MAJCOMs. Each MAJCOM supporting reconnaissance programs develops the necessary directives to implement the USAF Sensor System Evaluation Program. MAJCOMs assign responsibilities within the command for imagery evaluation consistent with facility capability, resources, and mission requirements.

c. **USAF Sensor Evaluation Center (USAF/SEC).** This organization is the focal point for doing sensor system performance evaluations for the Sensor System Evaluation Steering Group. It addresses problems for which solutions have not been found through normal organizational or depot methods. On approval, the USAF/SEC:

(1) Provides technical assistance to HQ USAF, the sensor System Evaluation Steering Group, and using organizations on NPS matters.

(2) Develops and coordinates standardized measurement methods for image evaluation for use in updating NPSs.

(3) Maintains liaison with user commands, supporting organizations, and staff agencies.

13. Levels of Evaluation. The levels of imagery evaluation required for sensor systems are established by the Sensor System Evaluation Steering Group and outlined in the specific NPS for each system covered.

SECTION E — SUPPORT ORGANIZATION AND DEPOT LEVEL PROGRAMS

14. Designation of USAF/CCF and USAF/SEC. The MAJCOM interface and support to the USAF Central Calibration Program and the Sensor System Evaluation Program must be incorporated into established functions supporting photographic reconnaissance systems. Most support procedures set up in this regulation normally are done through Air Force Logistics Command (AFLC) and Air Force Systems Command (AFSC) functions.

a. Ogden Air Logistics Center (AFLC) has been designated the USAF Central Calibration Facility (USAF/CCF). Specific focal points within this organization representing the Air Force Photographic Quality Assurance and Image Evaluation Program include OO-ALC/MMIRCP and OO-ALC/MACE, Hill AFB, Utah.

b. The Air Force Avionics Laboratory (AFSC) has been designated the USAF Sensor Evaluation Center (USAF/SEC). The focal point within this organization for USAF/SEC matters is AFAL/RWF, Wright-Patterson AFB, Ohio.

15. Need for Evaluation of Sensor Performance. The depot maintenance focal point for sensor performance evaluation matters is Ogden ALC, Hill AFB, Utah. Sensor performance testing following any necessary repair or updating of the sensor at depot level is necessary to verify whether it is achieving the level of performance set up in the NPS. Modified sensors or prototype sensors also require evaluation against established standards to calculate their expected gain to the operational users. Specific support organization and depot level functions are specified in each sensor system NPS. Provisions for periodic inspection and testing of sensors are set up for each system. Testing to the NPS at the depot maintenance level must be performed on:

a. New imaging sensors in acquisition cycle.

b. Existing imaging sensors in a planned re-cycling basis.

c. Existing imaging sensors sent to the depot for maintenance and overhaul.

SECTION F — MISCELLANEOUS

16. Environmental Standards for Photoprocessing Laboratories. The sophistication of the environmental control system must be consistent with the degree of photographic quality required. Critical operations such as film inspection, analysis, printing processing, and titling must be accomplished under the cleanest possible working conditions within the overall system. Specific assignment and production requirements must be the main reason for the degree of cleanliness required in any facility. Some facilities can satisfy their mission by setting up clean work stations, others require controlled area environments, and a few installations must maintain a near clean room environment. Minimum requirements for environmental standards for USAF continuous photographic processing and imagery evaluation facilities must be set up by each MAJCOM based on the mission of each facility.

17. Maintenance and Disposition of Records. Maintain and dispose of all Air Force forms, prescribed by this regulation, according to AFM 12-50.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

DAVID C. JONES, General, USAF
Chief of Staff

JAMES J. SHEPARD, Colonel, USAF
Director of Administration

SUMMARY OF REVISED, DELETED, OR ADDED MATERIAL

This revision expands the scope of the Air Force photographic quality assurance program to include standardization, evaluation, and quality control requirements for continuous photographic processing laboratories, redefines categories of image processing laboratories (para 4), frequency of sensitometer and densitometer calibrations changed (para 8 and 9), and the sensor system evaluation program established (para 10). This revision also specifies organizational focal points for the USAF Central Calibration Facility and the USAF Sensor Evaluation Center (para 14), and provides for other operational and depot level support functions (para 15), lists equipment certification frequency and application of quality assurance procedures by facility category (atch 1 and 2).

EQUIPMENT CERTIFICATION/STANDARDIZATION CHART

Equipment	Frequency Category "A" Facilities	Frequency Category "B" & "C" Facilities *	Test Reference	Applicable Forms
1. Continuous Automatic Processor	Prior to Mission Between Sensors	Within 30 Mins Prior to Mission Every 2 Hrs During Production	TO 10-1-6-2	AF Form 1600 AF Form 1601 (as applicable) AF Form 1605
2. Continuous Printer	Prior to Mission	Daily if Used at Least Monthly	TO 10-1-6-2	AF Form 1605
3. pH Meter	Each Use	Each Use	TO 10-1-6-2	AF Form 1604
4. Sensitometer	Before and After each Use	Before and After Each Use at Least Monthly	TO 10-1-6-2	AF Form 1600 AF Form 1605
5. Densitometer	Prior to Use	Daily if Used at Least Monthly	TO 10-1-6-2	AF Form 1605
6. Titler	Prior to Mission or Change of Sensor/Film Type	Each Shift if Used	Appropriate Equipment TO	AF Form 1604 AF Form 1605
7. Thermometer	At Least Monthly	At Least Monthly	Check Against Standard Calibrated Thermometer	AF Form 1605
8. Balance/Scale	As Required	As Required	TO 33K-1-100	AF Form 1605
9. Agentometer	Prior to Each Use	Each Use	Manufacturers Instructions or TO 10-1-6-2	AF Form 1605
10. Tachometer	As Required	As Required	TO 33K-1-100 and Appropriate Equipment to	AF Form 1605

*Category "D" Facilities as Required

QUALITY CONTROL AND ASSURANCE PROCEDURES

Title	Application by Category	Reference
1.i Developer		
a. pH	A B C D	TO 10-1-6-2 para 5.2.12.2 Appendix B
b. Specific Gravity	A B C D	TO 10-1-6-2 para 5.2.4. thru 5.2.8 Appendix B
c. Dip Test	A D	TO 10-1-6-2 Para 5.2.13.3 Appendix B
d. Total Alkalinity	A D	TO 10-1-6-2 Para 5.2.13 Appendix B
2.1 Fix		
a. Ph	A B C D	TO 10-1-6-2 Para 5.2.15.4 Appendix B
b. Clearing Test	A B D	TO 10-1-6-2 Para 5.2.15.6.1
3.1 Stop Bath pH	A D	TO 10-1-6-2 Appendix B
4.1 Water Filtration	A B C D	TO 10-1-6-2 Para 5.1.5
5.1 Processor		
a. Physical Certification	A B C D	TO 10-1-6-2 Para 8.6.3.1
b. Sensitometric Certification	A B C D	TO 10-1-6-2 Para 4.2.14
c. Processor Certification Aim Curve	A B C D	TO 10-1-6-2 Para 8.5
d. Start-up Roll	A D	TO 10-1-6-2 Para 4.2.11
e. Flow Meter	A B C D	Local Calibration, Manufacturers Handbook
f. Temperature Controls	A B C D	TO 10-1-6-2 Para 10.1.3
6.1 Printer		
a. Physical Certification	A B C D	TO 10-1-6-2 Para 4.1
b. Sensitometer and Tone Analysis	A B C D	TO 10-1-6-2 Para 4.1.12, 4.1.13 and 4.2.14
c. Image Definition	A B C D	TO 10-1-6-2 Para 4.1.7
7.1 Laboratory Production Standards		
a. Tone Controls	A B C D	TO 10-1-6-2 Para 9.1.1, 9.1.2 and 9.2
b. Aperture to Scale Print Point Selection	A B C D	TO 10-1-6-2 Para 9.3.3 and 9.4
8.1 Original Film Processing Standards	A B C D	TO 10-1-6-2 Para 10.3.2
a. Original Negative Aim Curve	A B C D	TO 10-1-6-2 Para 8.2, 8.4, and 8.5
b. Monitoring the Process	A B C D	TO 10-1-6-2 Para 10.3.2 thru 10.4
c. Titling	A B C D	TO 10-1-6-2 Para 4.3.2

Title	Application by Category	Reference
d. Head and Tail Identification Strips	A B C D	TO 10-1-6-2 Para 8.7
9.1 Exposure Monitoring and Control System (USAF/EMCS)	A B C D	TO 10-1-6-2 Para 11.5 thru 11.7
10.1 Control Stock Program		
a. Control Stock Selecting and Testing	A B C D	TO 10-1-6-2 Para 6.1 and 6.2
b. Emulsion Correlation (Cross- and Testing over)	A B C D	TO 10-1-6-2 Para 6.3
c. Control Strip Production	A B C D	TO 10-1-6-2 Para 6.3.3 and 6.3.4
d. Emulsion Speeds (EAFS)	A B C D	TO 10-1-6-2 Para 8.3 and 8.4
e. Gamma and Average Gradient (G)	A B C D	TO 10-1-6-2 Para 8.2
f. Base-Plus-Fog (B + F) Maximum Density (D/MAX) Minimum Density (D/MIN)	A B C D	TO 10-1-6-2 Para 9.1.3 thru 9.1.5.1
g. Evaluation of Raw Film Film Stock	A B C D	TO 10-1-6-2 Para 6.4
h. Film Storage	A B C D	AFM 67-9 TO 10J-1-4
11.1 Statistical Procedures	A B C D	TO 10-1-6-2 Para 3.1.14 thru 3.1.16